III. "On the Liquation of Metals of the Platinum Group." By
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Communicated by Sir G. G. STOKES, Bart., F.R.S. Received
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(Abstract.)

The author has continued a previous investigation of his own
which was published in the 'Proceedings of the Royal Society'
('Roy. Soc. Proc.,' 1890, vol. 47, pp. 180—186).

In the present paper he discusses, in much detail, the effects of the
cooling of large masses of the alloys gold-platinum, gold-palladium,
platinum-palladium, platinum-rhodium, and gold-aluminium.

The details of manipulation, which were of considerable difficulty,
are set forth in detail, as they involved melting masses of metal with
high melting points.

The author regrets that time has not enabled him to examine *more*
members of each particular series of alloys, so as to present results
in fuller detail : in fact, the silver-copper series is the only one upon
which anything like exhaustive work has been done.

No doubt, in every series of alloys there is one definite alloy which
would yield a uniform mass on cooling, and it is known that in the
silver-copper series this alloy (Levol's) contains 718 parts of silver
per thousand. It is not certain, however, that this is the eutectic
alloy of the series—that is, the one with the lowest melting point—
but it is well known that when silver-copper alloys which contain
more silver than 718 parts per thousand are cooled, the centre of the
solidified mass is richer than the exterior. This is the case with
standard silver, for instance, which contains 925 parts of silver per
thousand, and it is safe to conclude that an alloy rich in copper is the
first to fall out from the mass, and that this alloy sets round the
inner surface of the mould, driving a still fluid alloy, rich in silver,
to the centre. The general rule in the present results seems to be
that, *in the cooling of a fluid mass of two united metals an alloy rich in
the more fusible constituents of the mass falls out first, driving the less
fusible constituent to the centre.* The gold-platinum alloys (A, B, C, D,
and E) seem to be always rich in gold externally.

It is remarkable that the metals of the platinum group do not
show much liquation among themselves, but, on the other hand, when
gold is united to members of the platinum group, there is evidence
of liquation.

The gold-palladium one (F) follows the above rule.

There is evidence that the alloy E, containing 750 parts of platinum
and 250 of gold, is near the composition of a true compound, as it
shows but little sign of liquation, and is, moreover, hard and brittle,

differing materially from the rest of the series. The purple alloy of gold and aluminium M, $AuAl_2$, is almost certainly a true chemical compound, the solidified mass being as nearly uniform in composition as may be. The uniformity of the alloy (J) of platinum with 10 per cent. of rhodium is of much interest, in view of the important part which the alloy is playing in pyrometric work.

Conducting the experiments, the results of which are embodied in the present paper, has been very laborious, and although, as already stated, no complete series of the alloys of any two metals has been examined, quite sufficient data have been collected to afford valuable guidance to the metallurgist, who will now know what behaviour may be expected from the other members of the groups of the alloys in question. The gold-platinum series of alloys are of industrial importance, as native gold is so often associated with platinum, and it is somewhat surprising to find that assays made on pieces of metal cut from the exterior of an ingot cannot be trusted to represent the composition of the mass. The aim of the investigation has been to show, that notwithstanding the great difficulty which attends the preparation of alloys of metals with very high melting points, it is possible to elicit from them the same kind of information which has proved to be so useful in the case of the more ordinary and tractable alloys.

IV. "The Potential of an Anchor Ring." By F. W. DYSON, Fellow of Trinity College, Cambridge. Communicated by Professor J. J. THOMSON, F.R.S. Received March 19, 1892.

(Abstract.)

If r, θ, ϕ be the coordinates of any point outside an anchor ring, whose central circle is of radius c, then

$$\int_0^\pi \frac{d\phi}{\sqrt{(r^2+c^2-2cr\sin\theta\cos\phi)}}$$

and

$$\cos\phi \int_0^\pi \frac{\cos\phi\,d\phi}{\sqrt{(r^2+c^2-2cr\sin\theta\cos\phi)}}$$

are solutions of Laplace's equation, which are finite at all external points and vanish at infinity.

Let these be called I and J.

Then dI/dz and dJ/dz are also solutions of Laplace's equation.

Four sets of solutions are obtained by differentiating these integrals any number of times with respect to c.

Thus, I, dI/dc, d^2I/dc^2, &c., are all solutions of Laplace's equation, finite at all external points and vanishing at infinity.